Claims

1. Device for personal identification by means of at least one fingerprint

- with at least one light source (10) for illuminating and/or transilluminating the forward area of a finger by means of light pulses and

- with at least one fiber optic finger resting surface (30) for taking an optical picture of the fingerprint, by which finger resting surface (30) the optical image can be transported to at least one sensor unit (40) in which the optical image can be converted into electrical signals,

at least one light source (10) being located laterally next to the finger resting surface (30) and the light from the light source (10) can be radiated in the direction to the side of the finger resting surface (30) which is intended for resting the forward area of the finger and which faces away from the sensor unit (40),

wherein the duration and/or the intensity of the light pulses emitted by at least one light source (10) can be controlled depending on the ambient light conditions.

2. Device as claimed in claim 1, wherein at least one evaluation unit (70a) is located downstream of the sensor unit (40).

Sub A1 3. Device as claimed in claim 1 or 2, wherein the amplification of the electrical signals in the sensor unit (40) and/or in the evaluation unit (70a) is variable over the different regions of the optical image.

4. Device as claimed in claim 3, wherein the amplification of the electrical signals in the middle regions of the optical picture are greater than the amplification of the electrical signals in the edge regions of the optical image.

5. Device as claimed in claim 4, wherein the amplification of the electrical signals in the middle regions of the optical picture is greater by roughly a factor of 2 to 3 than the amplification of the electrical signals in the edge regions of the optical image.

Sub A2 6. Device as claimed in at least one of claims 1 to 5, wherein at least one storage unit (70b) is located downstream of the sensor unit (40).

7. Device as claimed in at least one of claims 1 to 6, wherein there is at least one control means

(40, 70) for controlling the duration and/or the intensity of the light pulses.

8. Device as claimed in claim 7, wherein the control means (40, 70) has

- at least one acquisition module for acquisition of the ambient light conditions,;
- at least one evaluation module for determining the duration and/or the intensity of the light pulses matched to the ambient light conditions acquired by the acquisition module; and
- at least one storage module for storing threshold values which have been determined for controlling the duration and/or the intensity of the light pulses.

9. Device as claimed in claim 8, wherein the acquisition module is made integrally with the sensor unit (40) and/or as part of the sensor unit (40).

Sub A3 10. Device as claimed in claim 2 and as claimed in claim 8 or 9, wherein the evaluation module is made integrally with the evaluation unit (70a) and/or as part of the evaluation unit (70a).

11. Device as claimed in claim 6 and at least one of claims 8 to 10, wherein the storage module is made integrally with the storage unit (70b) and/or as part of the storage unit (70b).

12. Device as claimed in at least one of claims 7 to 11, wherein the control means (40, 70) is made as at least one logic component and/or as at least one logic circuit.

13. Device as claimed in claim 12, wherein there is at least one standard logic component or programmable logic (FPGA = field programmable gate array) as the control means (40, 70).

Sub A4 14. Device as claimed in at least one of claims 7 to 13, wherein the control means (40, 70) is made as at least one digital signal processor (DSP) and/or as at least one microcontroller.

15. Device as claimed in at least one of claims 1 to 14, wherein the device is designed for passage into a neutral state.

16. Device as claimed in claim 15, wherein there is at least one capacitive circuit (75) by which the device after a stipulated interval of non-use passes into the neutral state.

Sub A5 17. Device as claimed in at least one of claims 7 to 14 and according to claim 16, wherein the capacitive circuit (75) is integrated into the control means (40, 70).

18. Device as claimed in at least one of claims 1 to 17, wherein there is more than one light source (10).

19. Device as claimed in claim 18, wherein there are four light sources (10).

20. Device as claimed in claim 18 or 19, wherein the light sources (10) are arranged symmetrically to one another.

21. Device as claimed in at least one of claims 18 to 20, wherein the light sources (10) are located laterally or annularly around the finger resting surface (30).

22. Device as claimed in at least one of claims 18 to 21, wherein the light source (10 are located uniformly distributed around the finger resting surface (30).

23. Device as claimed in at least one of claims 18 to 22, wherein the respective duration and/or the respective intensity of the light pulses emitted by the respective light source (10) can be selectively controlled as matched to the ambient light conditions.

24. Device as claimed in at least one of claims 18 to 23, wherein the respective duration and/or the respective intensity of the light pulses emitted by the individual light sources (10) can be controlled independently of one another.

25. Device as claimed in at least one of claims 18 to 24, wherein the respective duration and/or the respective intensity of the light pulses emitted by the individual light sources (10) can be selectively controlled depending on stipulated threshold values.

26. Device as claimed in at least one of claims 1 to 25, wherein the light source (10) is located on the side of the finger resting surface (30) facing the sensor unit (40).

27. Device as claimed in at least one of claims 1 to 26, wherein the light source (10) is spaced laterally away from the sensor unit (40).

28. Device as claimed in at least one of claims 1 to 27, wherein the light from the light source (10) is radiated in laterally in to the side of the finger resting surface (30) which is intended for resting the forward region of the finger and which faces away from the sensor unit (40).

29. Device as claimed in at least one of claims 1 to 28, wherein the light source (10) is made as a pulsed light source.

30. Device as claimed in claim 29, wherein the light source (10) is designed to emit light pulses with pulse duration from almost zero milliseconds to roughly ninety milliseconds.

Sub A7) 31. Device as claimed in claim 29 or 30, wherein there is at least one pulser unit for controlling the light source (10).

32. Device as claimed in at least one of claims 1 to 31, wherein there is at least one a display means (65) for displaying the various operating states of the device.

33. Device as claimed in claim 32, wherein the display means (65) has at least one monochrome or polychrome LED display which signals the various operating states of the device.

Sub A8) 34. Device as claimed in claim 32 or 33, wherein the display means (65) is integrated into the light source (10) and/or wherein the display means (65) and the light source (10) are made in one unit.

35. Device as claimed in at least one of claims 32 to 34, wherein the display means (65) signals the various operating states of the device by at least one blinking and/or pulsing light signal.

36. Device as claimed in at least one of claims 1 to 35, wherein at least one optical system (20) is located downstream of the light source (10).

37. Device as claimed in claim 36, wherein the optical system (20) deflects the light radiated from the light source (10) onto the side of the finger resting surface (30) facing away from the sensor unit (40) and/or wherein the optical system (20) distributes the light radiated from the light source (10) uniformly and/or diffusely on the side of the finger resting surface (30) facing away from the sensor unit (40).

Sub A9) 38. Device as claimed in claim 36 or 37, wherein the optical system (20) is made as at least one filter, at least one lens, as at least one prism, as at least one optical fiber, as at least one fiber optic element and/or as at least one mirror,

39. Device as claimed in at least one of claims 36 to 38, wherein the optical system (20) is made of plastic.

40. Device as claimed in at least one of claims 36 to 39, wherein at least the side of the optical system (20) facing away from the light source (10) is coated with a material (80) which is transparent to infrared light and/or to visible light.

41. Device as claimed in at least one of claims 1 to 40, wherein there is at least one finger guide on the side of the finger resting surface (30) which is provided for placement of the forward area of the finger and which faces away from the sensor unit (40).

42. Device as claimed in claim 41, wherein the finger guide is shaped ergonomically.

Sub A 16 43. Device as claimed in at least one of claims 36 to 40 and as claimed in claim 41 or 42, wherein the optical system (20) is made as a finger guide.

44. Device as claimed in at least one of claims 1 to 43, wherein at least the side of the finger resting surface (30) facing away from the sensor unit (40) is coated with a material (80) which is transparent to infrared light and/or to visible light.

45. Device as claimed in claim 40 or 44, wherein the material (80) which is transparent to infrared light and/or visible light is varnish.

46. Device as claimed in at least one of claims 1 to 45, wherein the light source (10) is a light-emitting diode (LED).

47. Device as claimed in at least one of claims 1 to 46, wherein the light source (10) emits infrared light.

48. Device as claimed in claim 47, wherein the infrared light has a wavelength of roughly 900 nanometers.

Sub A 17 49. Device as claimed in at least one of claims 1 to 48, wherein the light source (10) emits infrared light of two different wavelengths.

50. Device as claimed in at least one of claims 1 to 49, wherein the light source (10) has a power from roughly 0.1 milliwatt to roughly 5 watts.

51. Device as claimed in claim 50, wherein the light source (10) has a power from roughly two milliwatts to roughly 100 milliwatts.

Sub A 18 52. Device as claimed in at least one of claims 1 to 51, wherein the sensor unit (40) is located on at least one carrier unit (50).

53. Device as claimed in claim 52, wherein the carrier unit (50) is located on at least one circuit board unit (60).

Sub A 19 54. Device as claimed in at least one of claims 1 to 53, wherein the fibers (310) in the finger resting surface (30) are located essentially perpendicular to the entry surface and/or to the exit surface of the finger resting surface (30).

55. Device as claimed in at least one of claims 1 to 54, wherein the fibers (310) in the finger resting surface (30) are located essentially parallel to one another.

56. Device as claimed in at least one of claims 1 to 54, wherein the fibers (310, 320) in the finger resting surface (30) have essentially two directions which are arranged at an angle (α) to one another.

57. Device as claimed in claim 56, wherein the fibers (310, 320) in the finger resting surface (30) are arranged in layers, the fibers (310, 320) within one layer being essentially parallel to one another and the fibers (310, 320) of the layers which are adjacent to one another being located at an angle (α) to one another.

Sub A14 58. Device as claimed in claim 56 or 57, wherein there are fibers (320) of the finger resting surface (30) which are arranged in one direction at an angle (α) to the other direction for transport of the light to the side of the finger resting surface (30) facing away from the sensor unit (40) and wherein there are fibers (310) of the finger resting surface (30) which are located in the other direction for transport of the optical image of the fingerprint to the sensor unit (40).

59. Device as claimed in at least one of claims 1 to 58, wherein at least some of the fibers (310, 320) in the finger resting surface (30) are surrounded at least in sections by absorbing material in the form of a coating and/or in the form of a sleeve.

60. Device as claimed in at least one of claims 1 to 59, wherein at least some of the fibers (310, 320) in the finger resting surface (30) are surrounded at least in sections by reflecting material in the form of a coating and/or in the form of a sleeve.

61. Device as claimed in at least one of claims 1 to 60, wherein the finger resting surface (30) has an extension which extends into the area above the light source (10).

62. Device as claimed in at least one of claims 1 to 61, wherein within the finger resting surface (30) there is at least one opaque blocking layer (130).

63. Device as claimed in claim 62, wherein the blocking layer (130) is made in the form of closed fibers (310).

Sub A15 64. Device as claimed in at least one of claims 1 to 63, wherein there is at least one opaque blocking layer (140) between the light source (10) and the sensor unit (40).

65. Device as claimed in claim 62 or 64, wherein the material of the opaque blocking layer (130, 140) is varnish.

66. Device as claimed in at least one of claims 1 to 65, wherein there is at least one filter (90).

67. Device as claimed in claim 66, wherein the filter (90) is a linear filter.

68. Device as claimed in claim 66 or 67, wherein the filter (90) is located between the finger resting surface (30) and the sensor unit (40).

69. Device as claimed in at least one of claims 66 to 68, wherein the filter (90) is located on the side of the finger resting surface (30) facing away from the sensor unit (40) and/or on the side of the finger resting surface (30) facing the sensor unit (40).

70. Device as claimed in at least one of claims 66 to 69, wherein there is a filter (90) within the finger resting surface (30).

71. Device as claimed in at least one of claims 66 to 70, wherein the filter (90) has an absorption factor of roughly 99 percent.

72. Device as claimed in at least one of claims 66 to 71, wherein the absorption factor of the filter (90) is variable over the various regions of the optical image.

73. Device as claimed in claim 72, wherein the degree of absorption of the filter (90) in the edge areas of the optical image is greater than the absorption factor of the filter (90) in the middle regions of the optical image.

74. Device as claimed in claim 73, wherein the absorption of the filter (90) in the edge regions of the optical picture is greater by roughly a factor of 2 to 3 and/or by roughly six decibels to roughly ten decibels than the absorption of the filter (90) in the middle regions of the optical picture.

75. Device as claimed in at least one of claims 1 to 74, wherein the sensor unit (40) directly borders the finger resting surface (30) and/or wherein the sensor unit (40) is attached to the exit surface of the finger resting surface (30).

76. Device as claimed in at least one of claims 1 to 75, wherein the sensor unit (40) has at least one photosensitive surface and/or at least one photosensitive layer.

77. Device as claimed in at least one of claims 1 to 76, wherein the sensor unit (40) operates on a

semiconductor basis.

78. Device as claimed in claim 77, wherein the sensor unit (40) operates on a silicon basis.

79. Device as claimed in at least one of claims 1 to 78, wherein the sensor unit (40) has at least one component based on CMOS technology or at least one circuit based on CMOS technology (CMOS = complementary MOS).

80. Device as claimed in at least one of claims 1 to 79, wherein the sensor unit (40) has at least one charge-coupled component or at least one charge-coupled circuit (CCD = charge coupled device).

81. Device as claimed in at least one of claims 1 to 80, wherein the device is designed to detect life (so-called "life support").

82. Device as claimed in claim 49 and as claimed in claim 81, wherein the device is designed for determining the oxygen saturation in the blood of the forward area of the finger by comparison of the results obtained for two different wavelengths.

83. Device as claimed in at least one of claims 1 to 82, wherein the device is battery-operated.